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146550



THE UNITED STATES OF AMERICA

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April 07, 2005

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APPLICATION NUMBER: 60/553,659

FILING DATE: *March 16, 2004*

RELATED PCT APPLICATION NUMBER: PCT/US05/08458



Certified by

Under Secretary of Commerce
for Intellectual Property
and Director of the United States
Patent and Trademark Office

031604

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U.S. P.



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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No. ET122668029US

PTO/SB/16 (08-03)
 07/31/2006
 031604

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| INVENTOR(S) | | | |
|---|--|--|-----|
| Given Name (first and middle (if any)) | | Residence (City and either State or Foreign Country) | |
| Dany Norwin | | Assenede, Belgium Aardenburg, The Netherlands | |
| Family Name or Surname | | | |
| De Kock Van Riel | | | |
| <input type="checkbox"/> Additional inventors are being named on the _____ separately numbered sheets attached hereto | | | |
| TITLE OF THE INVENTION (500 characters max) | | | |
| METHOD FOR PREPARING LONG GLASS FIBER-REINFORCED COMPOSITION AND FABRICATED ARTICLES THEREFROM | | | |
| Direct all correspondence to: CORRESPONDENCE ADDRESS | | | |
| <input checked="" type="checkbox"/> Customer Number | | <input type="text" value="35161"/> | |
| OR | | | |
| <input type="checkbox"/> Firm or Individual Name | | | |
| Address | | | |
| Address | | | |
| City | | State | ZIP |
| Country | | Telephone | Fax |
| ENCLOSED APPLICATION PARTS (check all that apply) | | | |
| <input checked="" type="checkbox"/> Specification Number of Pages | | <input type="text" value="16"/> | |
| <input type="checkbox"/> Drawing(s) Number of Sheets | | <input type="text"/> | |
| <input type="checkbox"/> Application Data Sheet. See 37 CFR 1.76 | | <input checked="" type="checkbox"/> Other (specify) | |
| | | Express Mailing Certificate, Fee Transmittal for FY 2004, postcard | |
| METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT | | | |
| <input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. | | FILING FEE AMOUNT (\$) | |
| <input checked="" type="checkbox"/> A check or money order is enclosed to cover the filing fees | | <input type="text" value="\$160.00"/> | |
| <input type="checkbox"/> The Director is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number | | <input type="text"/> | |
| <input type="checkbox"/> Payment by credit card. Form PTO-2038 is attached. | | | |
| The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government. | | | |
| <input checked="" type="checkbox"/> No. | | | |
| <input type="checkbox"/> Yes, the name of the U.S. Government agency and the Government contract number are: _____ | | | |

Respectfully submitted,

SIGNATURE

Michael A. Schaldenbrand

Date

03/16/04

TYPED OR PRINTED NAME

Michael A. Schaldenbrand

REGISTRATION NO.

47,923

(if appropriate)

Docket Number:

25289-0025

TELEPHONE

(248) 433-7570

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

This collection of information is required by 37 CFR 1.51. The information is required to obtain or retain a benefit by the public, which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 8 hours to complete, including gathering, preparing, and submitting the completed application to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop Provisional Application,

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

FEE TRANSMITTAL for FY 2004

Effective 10/01/2003. Patent fees are subject to annual revision.

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT $\times > \$$ \$160.00

Complete if Known

Application Number _____
Filing Date _____
First Named Inventor **Dany De Kock**
Examiner Name _____
Art Unit _____
Attorney Docket No. **25289-0025**

| METHOD OF PAYMENT (check all that apply) | | | | FEE CALCULATION (continued) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| <input checked="" type="checkbox"/> Check <input type="checkbox"/> Credit card <input type="checkbox"/> Money Order <input type="checkbox"/> Other <input type="checkbox"/> None <input checked="" type="checkbox"/> Deposit Account: Deposit Account Number: 04-1061 Deposit Account Name: Dickinson Wright PLLC The Director is authorized to: (check all that apply) <input type="checkbox"/> Charge fee(s) indicated below <input checked="" type="checkbox"/> Credit any overpayments <input checked="" type="checkbox"/> Charge any additional fee(s) or any underpayment of fee(s) <input type="checkbox"/> Charge fee(s) indicated below, except for the filing fee to the above-identified deposit account. | | | | 3. ADDITIONAL FEES <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Large Entity Code</th> <th>Small Entity Code</th> <th>Fee (\$)</th> <th>Fee (\$)</th> <th>Fee Description</th> <th>Fee Paid</th> </tr> </thead> <tbody> <tr> <td>1051</td> <td>130</td> <td>2051</td> <td>65</td> <td>Surcharge - late filing fee or oath</td> <td></td> </tr> <tr> <td>1052</td> <td>50</td> <td>2052</td> <td>25</td> <td>Surcharge - late provisional filing fee or cover sheet</td> <td></td> </tr> <tr> <td>1053</td> <td>130</td> <td>1053</td> <td>130</td> <td>Non - English specification</td> <td></td> </tr> <tr> <td>1812</td> <td>2,520</td> <td>1812</td> <td>2,520</td> <td>For filing a request for ex parte reexamination</td> <td></td> </tr> <tr> <td>1804</td> <td>920*</td> <td>1804</td> <td>920*</td> <td>Requesting publication of SIR prior to Examiner action</td> <td></td> </tr> <tr> <td>1805</td> <td>1,840*</td> <td>1805</td> <td>1,840*</td> <td>Requesting publication of SIR after Examiner action</td> <td></td> </tr> <tr> <td>1251</td> <td>110</td> <td>2251</td> <td>55</td> <td>Extension for reply within first month</td> <td></td> </tr> <tr> <td>1252</td> <td>420</td> <td>2252</td> <td>210</td> <td>Extension for reply within second month</td> <td></td> </tr> <tr> <td>1253</td> <td>950</td> <td>2253</td> <td>475</td> <td>Extension for reply within third month</td> <td></td> </tr> <tr> <td>1254</td> <td>1,480</td> <td>2254</td> <td>740</td> <td>Extension for reply within fourth month</td> <td></td> </tr> <tr> <td>1255</td> <td>2,010</td> <td>2255</td> <td>1,005</td> <td>Extension for reply within fifth month</td> <td></td> </tr> <tr> <td>1401</td> <td>330</td> <td>2401</td> <td>165</td> <td>Notice of Appeal</td> <td></td> </tr> <tr> <td>1402</td> <td>330</td> <td>2402</td> <td>165</td> <td>Filing a brief in support of an appeal</td> <td></td> </tr> <tr> <td>1403</td> <td>290</td> <td>2403</td> <td>145</td> <td>Request for oral hearing</td> <td></td> </tr> <tr> <td>1451</td> <td>1,510</td> <td>1451</td> <td>1,510</td> <td>Petition to institute a public use proceeding</td> <td></td> </tr> <tr> <td>1452</td> <td>110</td> <td>2452</td> <td>55</td> <td>Petition to revive - unavoidable</td> <td></td> </tr> <tr> <td>1453</td> <td>1,330</td> <td>2453</td> <td>665</td> <td>Petition to revive - unintentional</td> <td></td> </tr> <tr> <td>1501</td> <td>1,330</td> <td>2501</td> <td>665</td> <td>Utility issue fee (or reissue)</td> <td></td> </tr> <tr> <td>1502</td> <td>480</td> <td>2502</td> <td>240</td> <td>Design issue fee</td> <td></td> </tr> <tr> <td>1503</td> <td>640</td> <td>2503</td> <td>320</td> <td>Plant issue fee</td> <td></td> </tr> <tr> <td>1460</td> <td>130</td> <td>1460</td> <td>130</td> <td>Petitions to the Commissioner</td> <td></td> </tr> <tr> <td>1807</td> <td>50</td> <td>1807</td> <td>50</td> <td>Processing fee under 37 CFR § 1.17(q)</td> <td></td> </tr> <tr> <td>1806</td> <td>180</td> <td>1806</td> <td>180</td> <td>Submission of Information Disclosure Statement</td> <td></td> </tr> <tr> <td>8021</td> <td>40</td> <td>8021</td> <td>40</td> <td>Recording each patent assignment per property (times number of properties)</td> <td></td> </tr> <tr> <td>1809</td> <td>770</td> <td>2809</td> <td>385</td> <td>Filing a submission after final rejection (37 CFR § 1.129(a))</td> <td></td> </tr> <tr> <td>1810</td> <td>770</td> <td>2810</td> <td>385</td> <td>For each additional invention to be examined (37 CFR § 1.129(b))</td> <td></td> </tr> <tr> <td>1801</td> <td>770</td> <td>2801</td> <td>385</td> <td>Request for Continued Examination (RCE)</td> <td></td> </tr> <tr> <td>1802</td> <td>900</td> <td>1802</td> <td>900</td> <td>Request for expedited examination of a design application</td> <td></td> </tr> <tr> <td colspan="5">Other fee (specify) _____</td> <td></td> </tr> <tr> <td colspan="5" style="text-align: right;">SUBTOTAL (3) $\times > \\$</td> <td></td> </tr> </tbody> </table> | | | | Large Entity Code | Small Entity Code | Fee (\$) | Fee (\$) | Fee Description | Fee Paid | 1051 | 130 | 2051 | 65 | Surcharge - late filing fee or oath | | 1052 | 50 | 2052 | 25 | Surcharge - late provisional filing fee or cover sheet | | 1053 | 130 | 1053 | 130 | Non - English specification | | 1812 | 2,520 | 1812 | 2,520 | For filing a request for ex parte reexamination | | 1804 | 920* | 1804 | 920* | Requesting publication of SIR prior to Examiner action | | 1805 | 1,840* | 1805 | 1,840* | Requesting publication of SIR after Examiner action | | 1251 | 110 | 2251 | 55 | Extension for reply within first month | | 1252 | 420 | 2252 | 210 | Extension for reply within second month | | 1253 | 950 | 2253 | 475 | Extension for reply within third month | | 1254 | 1,480 | 2254 | 740 | Extension for reply within fourth month | | 1255 | 2,010 | 2255 | 1,005 | Extension for reply within fifth month | | 1401 | 330 | 2401 | 165 | Notice of Appeal | | 1402 | 330 | 2402 | 165 | Filing a brief in support of an appeal | | 1403 | 290 | 2403 | 145 | Request for oral hearing | | 1451 | 1,510 | 1451 | 1,510 | Petition to institute a public use proceeding | | 1452 | 110 | 2452 | 55 | Petition to revive - unavoidable | | 1453 | 1,330 | 2453 | 665 | Petition to revive - unintentional | | 1501 | 1,330 | 2501 | 665 | Utility issue fee (or reissue) | | 1502 | 480 | 2502 | 240 | Design issue fee | | 1503 | 640 | 2503 | 320 | Plant issue fee | | 1460 | 130 | 1460 | 130 | Petitions to the Commissioner | | 1807 | 50 | 1807 | 50 | Processing fee under 37 CFR § 1.17(q) | | 1806 | 180 | 1806 | 180 | Submission of Information Disclosure Statement | | 8021 | 40 | 8021 | 40 | Recording each patent assignment per property (times number of properties) | | 1809 | 770 | 2809 | 385 | Filing a submission after final rejection (37 CFR § 1.129(a)) | | 1810 | 770 | 2810 | 385 | For each additional invention to be examined (37 CFR § 1.129(b)) | | 1801 | 770 | 2801 | 385 | Request for Continued Examination (RCE) | | 1802 | 900 | 1802 | 900 | Request for expedited examination of a design application | | Other fee (specify) _____ | | | | | | SUBTOTAL (3) $\times > \$$ | | | | | |
| Large Entity Code | Small Entity Code | Fee (\$) | Fee (\$) | Fee Description | Fee Paid | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1051 | 130 | 2051 | 65 | Surcharge - late filing fee or oath | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1052 | 50 | 2052 | 25 | Surcharge - late provisional filing fee or cover sheet | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1053 | 130 | 1053 | 130 | Non - English specification | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1812 | 2,520 | 1812 | 2,520 | For filing a request for ex parte reexamination | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1804 | 920* | 1804 | 920* | Requesting publication of SIR prior to Examiner action | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1805 | 1,840* | 1805 | 1,840* | Requesting publication of SIR after Examiner action | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1251 | 110 | 2251 | 55 | Extension for reply within first month | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1252 | 420 | 2252 | 210 | Extension for reply within second month | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1253 | 950 | 2253 | 475 | Extension for reply within third month | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1254 | 1,480 | 2254 | 740 | Extension for reply within fourth month | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1255 | 2,010 | 2255 | 1,005 | Extension for reply within fifth month | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1401 | 330 | 2401 | 165 | Notice of Appeal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1402 | 330 | 2402 | 165 | Filing a brief in support of an appeal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1403 | 290 | 2403 | 145 | Request for oral hearing | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1451 | 1,510 | 1451 | 1,510 | Petition to institute a public use proceeding | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1452 | 110 | 2452 | 55 | Petition to revive - unavoidable | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1453 | 1,330 | 2453 | 665 | Petition to revive - unintentional | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1501 | 1,330 | 2501 | 665 | Utility issue fee (or reissue) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1502 | 480 | 2502 | 240 | Design issue fee | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1503 | 640 | 2503 | 320 | Plant issue fee | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1460 | 130 | 1460 | 130 | Petitions to the Commissioner | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1807 | 50 | 1807 | 50 | Processing fee under 37 CFR § 1.17(q) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1806 | 180 | 1806 | 180 | Submission of Information Disclosure Statement | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8021 | 40 | 8021 | 40 | Recording each patent assignment per property (times number of properties) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1809 | 770 | 2809 | 385 | Filing a submission after final rejection (37 CFR § 1.129(a)) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1810 | 770 | 2810 | 385 | For each additional invention to be examined (37 CFR § 1.129(b)) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1801 | 770 | 2801 | 385 | Request for Continued Examination (RCE) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1802 | 900 | 1802 | 900 | Request for expedited examination of a design application | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Other fee (specify) _____ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SUBTOTAL (3) $\times > \$$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. BASIC FILING FEE <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Large Entity Code</th> <th>Small Entity Code</th> <th>Fee (\$)</th> <th>Fee (\$)</th> <th>Fee Description</th> <th>Fee Paid</th> </tr> </thead> <tbody> <tr> <td>1001</td> <td>770</td> <td>2001</td> <td>385</td> <td>Utility filing fee</td> <td></td> </tr> <tr> <td>1002</td> <td>340</td> <td>2002</td> <td>170</td> <td>Design filing fee</td> <td></td> </tr> <tr> <td>1003</td> <td>530</td> <td>2003</td> <td>285</td> <td>Plant filing fee</td> <td></td> </tr> <tr> <td>1004</td> <td>770</td> <td>2004</td> <td>385</td> <td>Reissue filing fee</td> <td></td> </tr> <tr> <td>1005</td> <td>160</td> <td>2005</td> <td>80</td> <td>Provisional filing fee</td> <td>160.00</td> </tr> <tr> <td colspan="5" style="text-align: right;">SUBTOTAL (1) $\times > \\$</td> <td>160.00</td> </tr> </tbody> </table> | | | | Large Entity Code | Small Entity Code | Fee (\$) | Fee (\$) | Fee Description | Fee Paid | 1001 | 770 | 2001 | 385 | Utility filing fee | | 1002 | 340 | 2002 | 170 | Design filing fee | | 1003 | 530 | 2003 | 285 | Plant filing fee | | 1004 | 770 | 2004 | 385 | Reissue filing fee | | 1005 | 160 | 2005 | 80 | Provisional filing fee | 160.00 | SUBTOTAL (1) $\times > \$$ | | | | | 160.00 | 2. EXTRA CLAIM FEES FOR UTILITY AND <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2">Extra Claims</th> <th>Fee from below</th> <th>Fee Paid</th> </tr> </thead> <tbody> <tr> <td>Total Claims</td> <td>$10^{**} = 0$</td> <td>X $0 =$</td> <td>0.00</td> </tr> <tr> <td>Independent Claims</td> <td>$3^{**} = 0$</td> <td>X $0 =$</td> <td>0.00</td> </tr> <tr> <td>Multiple Dependent</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> | | | | Extra Claims | | Fee from below | Fee Paid | Total Claims | $10^{**} = 0$ | X $0 =$ | 0.00 | Independent Claims | $3^{**} = 0$ | X $0 =$ | 0.00 | Multiple Dependent | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Large Entity Code | Small Entity Code | Fee (\$) | Fee (\$) | Fee Description | Fee Paid | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1001 | 770 | 2001 | 385 | Utility filing fee | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1002 | 340 | 2002 | 170 | Design filing fee | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1003 | 530 | 2003 | 285 | Plant filing fee | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1004 | 770 | 2004 | 385 | Reissue filing fee | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1005 | 160 | 2005 | 80 | Provisional filing fee | 160.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SUBTOTAL (1) $\times > \$$ | | | | | 160.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Extra Claims | | Fee from below | Fee Paid | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Total Claims | $10^{**} = 0$ | X $0 =$ | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Independent Claims | $3^{**} = 0$ | X $0 =$ | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Multiple Dependent | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Large Entity / Small Entity <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Large Entity Code</th> <th>Small Entity Code</th> <th>Fee (\$)</th> <th>Fee (\$)</th> <th>Fee Description</th> </tr> </thead> <tbody> <tr> <td>1202</td> <td>18</td> <td>2202</td> <td>9</td> <td>Claims in excess of 20</td> </tr> <tr> <td>1201</td> <td>86</td> <td>2201</td> <td>43</td> <td>Independent claims in excess of 3</td> </tr> <tr> <td>1203</td> <td>260</td> <td>2203</td> <td>145</td> <td>Multiple dependent claim, if not paid</td> </tr> <tr> <td>1204</td> <td>86</td> <td>2204</td> <td>43</td> <td>** Reissue independent claims over original patent</td> </tr> <tr> <td>1205</td> <td>18</td> <td>2205</td> <td>9</td> <td>** Reissue claims in excess of 20 and over original patent</td> </tr> <tr> <td colspan="5" style="text-align: right;">SUBTOTAL (2) $\times > \\$</td> <td>0.00</td> </tr> </tbody> </table> | | | | Large Entity Code | Small Entity Code | Fee (\$) | Fee (\$) | Fee Description | 1202 | 18 | 2202 | 9 | Claims in excess of 20 | 1201 | 86 | 2201 | 43 | Independent claims in excess of 3 | 1203 | 260 | 2203 | 145 | Multiple dependent claim, if not paid | 1204 | 86 | 2204 | 43 | ** Reissue independent claims over original patent | 1205 | 18 | 2205 | 9 | ** Reissue claims in excess of 20 and over original patent | SUBTOTAL (2) $\times > \$$ | | | | | 0.00 | Large Entity / Small Entity <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Large Entity Code</th> <th>Small Entity Code</th> <th>Fee (\$)</th> <th>Fee (\$)</th> <th>Fee Description</th> </tr> </thead> <tbody> <tr> <td>1202</td> <td>18</td> <td>2202</td> <td>9</td> <td>Claims in excess of 20</td> </tr> <tr> <td>1201</td> <td>86</td> <td>2201</td> <td>43</td> <td>Independent claims in excess of 3</td> </tr> <tr> <td>1203</td> <td>260</td> <td>2203</td> <td>145</td> <td>Multiple dependent claim, if not paid</td> </tr> <tr> <td>1204</td> <td>86</td> <td>2204</td> <td>43</td> <td>** Reissue independent claims over original patent</td> </tr> <tr> <td>1205</td> <td>18</td> <td>2205</td> <td>9</td> <td>** Reissue claims in excess of 20 and over original patent</td> </tr> <tr> <td colspan="5" style="text-align: right;">SUBTOTAL (2) $\times > \\$</td> <td>0.00</td> </tr> </tbody> </table> | | | | Large Entity Code | Small Entity Code | Fee (\$) | Fee (\$) | Fee Description | 1202 | 18 | 2202 | 9 | Claims in excess of 20 | 1201 | 86 | 2201 | 43 | Independent claims in excess of 3 | 1203 | 260 | 2203 | 145 | Multiple dependent claim, if not paid | 1204 | 86 | 2204 | 43 | ** Reissue independent claims over original patent | 1205 | 18 | 2205 | 9 | ** Reissue claims in excess of 20 and over original patent | SUBTOTAL (2) $\times > \$$ | | | | | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| SUBMITTED BY | | Complete (if applicable) | |
|-------------------|--------------------------|-----------------------------------|----------------|
| Name (Print/Type) | Michael A. Schaldenbrand | Registration No. (Attorney/Agent) | 47,923 |
| Signature | | Telephone | (248) 433-7570 |
| | | Date | March 16, 2004 |

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25289-0025

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Examiner

Group Art Unit

Invention: **METHOD FOR PREPARING LONG GLASS FIBER-REINFORCED COMPOSITION AND FABRICATED ARTICLES THEREFROM**

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March 16, 2004*(Date)*Tina Tomayko*(Typed or Printed Name of Person Mailing Correspondence)**(Signature of Person Mailing Correspondence)*ET122668029US*("Express Mail" Mailing Label Number)***Note: Each paper must have its own certificate of mailing.**

METHOD FOR PREPARING LONG GLASS FIBER-REINFORCED COMPOSITION AND FABRICATED ARTICLES THEREFROM

FIELD OF THE INVENTION

The present invention concerns a process for preparing a long fiber glass-filled thermoplastic composition and fabricated articles therefrom.

BACKGROUND OF THE INVENTION

It is well known that the physical properties of thermoplastics can be improved by the incorporation of filler materials such as glass fibers. The incorporation of reinforcing fibers into polymeric products beneficially affects resin properties such as tensile strength, stiffness, dimensional stability and resistance to creep and thermal expansion. Traditional methods of producing such articles have been through use in standard, pre-compounded short fiber glass-filled ABS. While satisfying certain objectives in optimizing the quality of the finished product, conventional methods have proven to be commercially costly and in other ways have fallen short of their objectives in terms of density, impact performance and strength. A lower cost solution to the known methods of producing fiber-reinforced articles is desired.

Certain steps have been taken in overcoming the deficiencies of known methods by incorporating long glass fibers into thermoplastic material for producing a long fiber-reinforced thermoplastic article. In this regard reference may be had to WO 01/02471, titled LONG FIBER-REINFORCED THERMOPLASTIC MATERIAL AND METHOD FOR PRODUCING THE SAME. According to this reference, long glass fibers are impregnated with a first thermoplastic material. The matrix of the material is composed of at least two different thermoplastics, thus enabling the fibers to be wet by one of the two thermoplastic materials. The resulting article demonstrates improved physical, chemical and electrochemical properties. However, while demonstrating an improvement in the state of technology, the process set forth in WO 01/02471 is

burdened by the requirement to employ at least two thermoplastics for production of the glass fiber reinforced granulate.

Reference may also be had to WO 0003852, titled GRANULES FOR THE PRODUCTION OF A MOLDING WITH A CLASS-A SURFACE, PROCESS FOR THE PRODUCTION OF GRANULES AND ITS USE. According to this reference, a granulate for the production of Class-A surface moldings is provided. The granulate comprises a thermoplastic polymer and long fiber material. The fiber material is provided with lengths in the range of 1 to 25 mm. While also demonstrating an improvement in the state of technology, this reference is limited in its application to articles requiring Class-A surfaces and, furthermore, is limited by its inherent inability to achieve performance benefits realized through the use of amorphous polymers.

Further reference may be made to U.S. Patent No. 5,783,129, titled APPARATUS, METHOD, AND COATING DIE FOR PRODUCING LONG FIBER-REINFORCED THERMOPLASTIC RESIN COMPOSITION. According to this reference a method is disclosed for producing a long fiber-reinforced thermoplastic resin composition composed of a thermoplastic resin and fiber bundles. The preferred resins are selected from the group which includes semi-crystalline polymers like polyolefins, polyesters, and polyamides. A reference to the same assignee, U.S. Patent No. 5,788,908 for METHOD FOR PRODUCING FIBER-REINFORCED THERMOPLASTIC RESIN COMPOSITION, is similar in that it too discloses a method for producing long fiber-reinforced thermoplastic resin composition. According to the disclosed method of production, a web-like continuous fiber bundle is impregnated with a thermoplastic resin melt to form a composite material. As with the preceding reference, the preferred resins

are selected from the group which includes semi-crystalline polymers like polyolefins, polyesters, and polyamides. While these methods provide certain advantages over the prior art, the products produced by these methods are not able to demonstrate desired dimensional performance.

It would therefore be desirable to find an efficient and effective means of producing long glass fiber-reinforced articles that demonstrate lowered density, improved impact properties, improved strength properties, and superior dimensional stability as achieved with amorphous polymers but at reduced production costs.

SUMMARY OF THE INVENTION

The present invention addresses the deficiencies of the art by providing a process for preparing a superior long glass fiber-reinforced composition for the production of a glass fiber-reinforced article of manufacture generally comprising:

- (a) Selecting a quantity of long glass fiber;
- (b) adding the selected quantity of long glass fiber to a first copolymer to form a master-batch, the first copolymer being a high flow copolymer; and
- (c) blending the master-batch with a second copolymer, the second copolymer being a stiffer flowing amorphous styrenic copolymer.

The first copolymer, the high flow copolymer, is preferably styrene-acrylonitrile (SAN), although others polymers may be used in addition to or in lieu thereof when forming a homogeneous blend with the stiffer flowing amorphous styrenic copolymer. The second copolymer, the stiffer flowing styrenic copolymer, is acrylonitrile-butadiene-styrene (ABS), although others may be used in addition to or in lieu thereof. The master-batch is preferably dry-blended or is dosed by the use of a mixing unit with the second styrenic copolymer.

DETAILED DESCRIPTION OF THE INVENTION

The present invention provides a process for the preparation of a superior long fiber glass-filled thermoplastic composition for use in the production of a molded article that demonstrates high dimensional stability. The method for producing the composition of the present invention offers a low-cost approach to the production of a moldable compound having low density and high impact strength when compared to products produced by known methods.

The process of the present invention for the preparation of a fiber-reinforced product comprises the general steps of selecting a quantity of long glass fiber, adding the selected quantity of long glass fiber to a high flow of a first copolymer to form a master-batch, blending the master-batch with a second stiffer flowing styrenic copolymer to form an injection moldable or compression moldable glass fiber-reinforced resin compound, injecting the resin compound into a mold, and recovering a fiber-reinforced polymerized part.

The targeted fiber length in the master-batch is between 3.0 mm and 25.0 mm with an average length of about 15.0 mm. Long glass fibers or a plurality of glass strands bundled in the form of widely-used glass roving may be incorporated. Specific glass rovings may be used for particular applications. In any event, typically the glass fibers will be substantially uniform in length, with the length dependent upon the granule size of the long glass fiber master-batch.

The targeted average fiber length in the final product is between 0.5 mm and 25.0 mm with a preferred average length between 3.0 mm and 8.0 mm when injected molded. In the event that the pellets are compression molded, the fiber length will be

related to the size of the pellets, e.g., the fiber length would be between 11.0 mm and 25.0 mm.

The glass fibers are added to a flow of a carrier melt. The carrier is a high flow copolymer which provides sufficient wetting and reduced shear forces on the glass fibers to avoid uncontrolled sizing but sufficient dispersion. The carrier material is a high flow version of, or forms a homogenous mixture with, the second stiffer flowing unreinforced amorphous unfilled material. The carrier may consist of both amorphous or functionalized semi-crystalline materials or blends thereof. Preferably the carrier is a styrene-acrylonitrile (SAN) such as Tyril® (trademark, Dow Chemical Company) or acrylonitrile-butadiene-styrene (ABS) such as MAGNUM® (trademark, Dow Chemical Company) or a styrene-maleic anhydride (SMA) such as DYLARC® (trademark, Arco Chemical Company). As a variation to the use of a styrenic-based carrier, alternate high flow versions engineering thermoplastic resins may be used or blended with the styrenic-based carrier such as polycarbonate (PC) such as CALIBRE® (trademark, Dow Chemical Company) or a thermoplastic polyurethane such as ISOPLAST® (trademark, Dow Chemical Company).

Although there are alternative methods for adding the glass fibers to the carrier flow, the glass fiber may be added to the high flow carrier melt by way of a side feeder of the compounding unit. Preferably the glass fiber is added to the high flow carrier melt in such an amount so that sufficient wetting and dispersion is achievable. A glass fiber concentration of 75% is possible but may provide a high vulnerability to poor dispersion. Preferably the glass fiber concentration is in the range of between about 40% and 60%

with the overall objective being to provide as high a concentration as possible while minimizing poor dispersion.

Once the master-batch is formed it is dry-blended with the stiffer flowing unreinforced, second amorphous copolymer. Preferably the second unreinforced amorphous material is a styrenic copolymer such as an acrylate styrene acrylonitrile (ASA), ABS, or SMA. This neat polymer will contribute to the strength and heat of the final blend. By use of the master-batch concept, the high level performance of the second polymer is not compromised with additional material characteristics as required for a high dosing level LG fiber reinforcing process.

The addition level of the master-batch is between about 10% and about 40% depending on the required stiffness and dimensional performance of the final article.

The resulting dry blend is injected molded under standard injection conditions for the second non-reinforced polymer into a mold. The resulting glass fiber-reinforced article is thereafter removed from the mold.

A broad variety of additives may be included in the thermoplastic resins set forth above according to the specific applications and use of the resin composition. Such additives may include one or more of colorants, de-molding agents, anti-oxidants, UV stabilizers or inorganic fillers

In general, a fiber-reinforced molded article produced according to the method for the present invention achieved several unexpected results. Of these results it was found that fewer glass fibers were needed to obtain a similar heat performance when compared with articles prepared according to known methods. It was also found that the resulting article had lower density and reduced weight when compared with such

articles. Furthermore, the resulting article demonstrated improved impact performance, strength levels and heat resistance (at equivalent levels of stiffness) over articles produced according to known methods.

The process of the present invention is illustrated by the following practical example and comparative testing wherein all parts and percentages are by volume unless otherwise specified.

PRACTICAL EXAMPLE

A long glass fiber master-batch is prepared using glass roving added, via a pultrusion or co-extrusion process, into a high flow SAN melt. The obtained glass fiber content in the master-batch was between 55% and 60%. This master-batch was dry-blended with several neat mass ABS resins in blending ratios between 15% and 35%. The dry-blend was used for molding articles in an injection molding machine under standard ABS conditions into an ISO test specimen.

COMPARATIVE TESTING

The table below shows the obtained physical properties for three different dry blends prepared in accordance with the practical example set forth above with the exception of specified variations in glass levels in the master-batch and targeted glass fiber levels. Comparisons were made with a commercially available 16% short glass fiber containing ABS (Reference 1) compound and a commercially available 17% short glass fiber containing ABS (Reference 2).

| | Load | neat ABS grade | Sample 1 MAGNUM® 3404 | Sample 2 MAGNUM® 3404 | Sample 3 MAGNUM® 3416 | Reference 1 | Reference 2 |
|------------|-------|-------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------|-------------|
| Norm | Unit | Addition lvi LFG MB | 26% | 35% | 30% | 0 | 0 |
| | | Targeted Glass lvi | 15% | 20% | 17% | 16% | 17% |
| | kg/l | Density | 1.145 | 1.191 | 1.16 | 1.16 | 1.17 |
| | % | ash content | 13.8 | 19 | 16 | 16 | |
| ISO 178 | MPa | Flex. mod. (regr. 0.05-0.25%) | 5279 | 5910 | 6201 | 5519 | 4700 |
| ISO 178 | MPa | Flex strength | 134 | 145 | 150 | 103 | 90 |
| ISO 527-2 | MPa | Tensile yield | 88 | 99 | 99 | 74 | 65 |
| ISO 527-2 | % | Elongation at rupture | 2.3 | 1.9 | 2.1 | 1.7 | |
| ISO 527-2 | MPa | Regr. modulus (0.05-0.25%) | 4810 | 6200 | 5857 | 5575 | 5100 |
| ISO 179/1f | kJ/m² | Unnotched Charpy impact 23°C | 23.2 | 22.8 | 24.5 | 18 | |
| ISO 179/1e | kJ/m² | Notched Izod impact 23°C | 14.2 | 14.6 | 14.2 | 6 | 7 |
| ISO 75A | °C | HDT 1.8MPa | 104 | 119 | 109 | 102 | 96 |
| ISO 306 | °C | Vicat 50°C/hr 5kg | 106 | 110 | 113 | 106 | 101 |
| ISO6603-2 | J | Total energy | 8.5 | 8.8 | 8.2 | 4.6 | |

"Magnum" is a registered trademark of the Dow Chemical Company.

As the comparative results illustrate, the articles produced according to the composition and method of the present invention demonstrate superior qualities in several areas, including reduced density, increased modulus, increased strength, improved notched impact strength and practical toughness and improved heat resistance.

It is understood that the above are merely preferred embodiments and that various changes and alterations can be made without departing from the spirit and broader aspects of the invention.

CLAIMS

What is claimed is:

1. A method for producing a long glass fiber-reinforced thermoplastic resin composition, the method comprising the steps of:
 - selecting a quantity of long glass fiber;
 - adding the selected quantity of long glass fiber to a first copolymer to form a master-batch, said first copolymer being a high flow copolymer; and
 - blending the master-batch with a second copolymer.
2. The method in accordance with Claim 1 wherein the first and second copolymers are styrenic copolymers.
3. The method in accordance with Claim 1 wherein the first copolymer is selected from the group consisting of styrene-acrylonitrile (SAN), acrylonitrile-butadiene-styrene (ABS), and an alloy of ABS resins.
4. The method in accordance with Claim 1 wherein the second copolymer is a stiffer flowing material selected from the group consisting of acrylonitrile-butadiene-styrene (ABS), styrene-maleic anhydride (SMA), acrylate styrene acrylonitrile (ASA), and alloys thereof.

5. The method in accordance with Claim 1 wherein the second copolymer is a stiffer flowing material and blends with the first copolymer to form a homogeneous blend.

6. The method in accordance with Claim 1 wherein the second copolymer is a stiffer flowing amorphous styrenic copolymer.

7. The method in accordance with Claim 1 wherein the selected quantity of glass fibers is added to a high flow of the first copolymer.

8. The method in accordance with Claim 1 wherein the selected quantity of glass fibers is added to the first copolymer in such an amount so that the resulting master-batch has a glass fiber concentration of between about 40% and 75%.

9. The method in accordance with Claim 1 wherein the blending ratio of the master-batch with the second copolymer is between about 10% and about 40%.

10. The method in accordance with Claim 1 wherein the long glass fiber is glass roving.

11. The method in accordance with Claim 1 wherein the master-batch is dry-blended with the second copolymer.

12. The method in accordance with Claim 1 wherein the second copolymer is a neat mass acrylonitrile-butadiene-styrene (ABS) resin.

13. A method for producing a long glass fiber-reinforced thermoplastic resin composition, the method comprising the steps of:

selecting a quantity of long glass fiber;

adding the selected quantity of long glass fiber to a first copolymer to form a master-batch, the first copolymer being selected from the group consisting of styrene-acrylonitrile (SAN), acrylonitrile-butadiene-styrene (ABS), an alloy of ABS resins, and polycarbonate; and

dry blending the master-batch with a second copolymer selected from the group consisting of acrylonitrile-butadiene-styrene (ABS), styrene-maleic anhydride (SMA), acrylate styrene acrylonitrile (ASA), and alloys thereof.

14. The method in accordance with Claim 13 wherein the first copolymer is a high flow copolymer.

15. The method in accordance with Claim 13 wherein the second copolymer is a stiffer flowing material and blends with the first copolymer to form a homogeneous blend.

16. The method in accordance with Claim 13 wherein the selected quantity of glass fibers is added to a high flow of the first copolymer.

17. The method in accordance with Claim 13 wherein the selected quantity of glass fibers is added to the first copolymer in such an amount so that the resulting master-batch has a glass fiber concentration of between about 40% and about 75%.

18. The method in accordance with Claim 13 wherein the blending ratio of the master-batch with the second copolymer is between about 10% and about 40%.

19. The method in accordance with Claim 13 wherein the long glass fiber is glass roving.

20. A glass fiber-reinforced article manufactured by the process comprising:
adding a quantity of long glass fiber to a first copolymer to form a master-batch, the first copolymer being a high flow copolymer selected from the group consisting of styrene-acrylonitrile (SAN), acrylonitrile-butadiene-styrene (ABS), an alloy of ABS resins, and polycarbonate;

blending the master-batch with a second copolymer selected from the group consisting of acrylonitrile-butadiene-styrene (ABS), styrene-maleic anhydride (SMA), acrylate styrene acrylonitrile (ASA), and alloys thereof to form an injectable composition; and

injecting the composition into a mold.

ABSTRACT

Process for production of a long fiber glass-filled ABS comprising (a) forming a long glass fiber master-batch by adding a long glass fiber to a high flow styrene-acrylonitrile (SAN) copolymer and (b) blending the master-batch with neat mass ABS resin. A molded article demonstrating high dimensional stability, good impact, strength and heat performance is obtained.